Thyroid cancer in Belarus after Chernobyl: International Thyroid Project

World Health Organization
European Centre for Environment and Health
Rome Division

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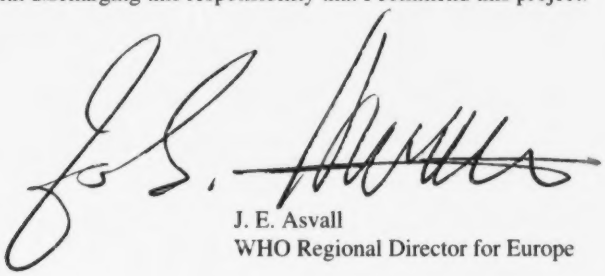
Foreword

The health impact of the Chernobyl nuclear accident in 1986 is still uncertain, in spite of the very considerable efforts that have been taken both by the countries most affected and by the international community. The reasons are complex. The lack of a comprehensive basic understanding of the health effects of the exposure to ionizing radiation and thus a secure knowledge of the relationship between exposure and effect is high on the list, but the extent of exposure following environmental contamination can depend on many factors, including the behaviour of individuals, even when the distribution of radioactivity in the environment is well known from dosimetric studies. Thus, when, as after Chernobyl, a very extensive area is contaminated (and in this case the contamination affected much of western Europe as well as much of the western part of the former Soviet Union) the task of estimating population exposure, especially to short-lived isotopes, becomes extremely demanding.

In the case of an operating nuclear reactor, and more so with the fallout from the detonation of a nuclear weapon, the short-lived fission products can assume great importance. Of especial concern are the isotopes of iodine because of their affinity for the thyroid gland, which is very sensitive to the effects of radiation in inducing both benign and malignant conditions. However there is a paradox here. Perhaps the best known isotope of iodine is I-131, which has proved invaluable in the treatment of thyroid disease without indication of serious carcinogenic effect. The scepticism with which the claims of an increased incidence of thyroid cancer in children from Belarus were initially met by the scientific community may perhaps be best explained by its belief in the generalization of this established result. However, there is no experience in the use of I-131 with children and those close to Chernobyl were also exposed to other isotopes of iodine.

Indeed, the situation that occurred after Chernobyl has no real precedent in the history of radiological protection and this is what makes the International Thyroid Project so important from the scientific point of view. But other aspects are also important. Firstly, it is vital for the newly created state of Belarus, a substantial part of whose territory was contaminated in the accident, to understand the origin of the increase, to consider whether there are measures to mitigate it and to know what will be the likely extent of the outbreak. At present the radiological protection community cannot answer these questions with confidence. Secondly, it is important for all countries with nuclear power programmes and those who are neighbours to such countries to understand the answers to these questions, and to consider whether, in a similar future event, different actions would be taken.

Finally, the European Region is home to the world's greatest concentration of nuclear activities, more than half of its total inventory of power reactors, much of its uranium mining capacity and fuel reprocessing facilities, and a major proportion of its military inventory. The WHO Regional Office for Europe, and in particular its Rome Division of the European Centre for Environment and Health, clearly have responsibilities to ensure that if there are releases to the environment, or a potential for exposure of its citizens to unsafe levels of radioactivity, the consequences for health are fully understood. It is in connection with discharging this responsibility that I commend this project.



J. E. Asvall
WHO Regional Director for Europe

ПРЕДИСЛОВИЕ

Чернобыльская авария продемонстрировала то, что было известно всегда, но, вероятно, не всегда осознавалось должным образом, а именно: границы стран или иные географические границы не защищают от радиоактивных осадков. Значительная часть населения Беларуси (около 2,2 млн. человек), составляющего примерно 10 млн. человек, подверглась и все еще подвергается последствиям радиоактивного облучения в результате аварии. Наиболее очевидно неблагоприятное влияние радиационного фактора на состояние тиреоидной системы у детей. Сейчас, по прошествии всего лишь семи лет после катастрофы, мы являемся свидетелями увеличения числа детей, заболевших раком щитовидной железы, что особенно характерно для местностей, расположенных наиболее близко к месту аварии. Рак щитовидной железы в раннем детском возрасте является исключительно редким явлением, и хотя в настоящее время число случаев заболеваний (примерно 200 со времени аварии) не является значительным в абсолютном выражении, все же это - достаточно серьезное явление, чтобы привлечь к себе внимание международного медицинского и научного сообщества и вызвать значительную тревогу по поводу дальнейшего распространения вспышки заболевания.

Хотя это увеличение числа случаев рака щитовидной железы пока еще не отнесено окончательно на счет Чернобыльской аварии и основной целью проекта является выявление причин аварии, все же факт воздействия изотопов йода на население Беларуси во время аварии и уроки последствий для Маршалловых островов испытания первой водородной бомбы на атолле Бикини заставляют нас рассматривать Чернобыльскую аварию в качестве наиболее вероятной причины вышеназванного роста заболеваемости.

Беларусь - относительно небольшая страна и обрела свою независимость недавно. Какие бы мерки мы ни применяли, Чернобыльская авария была технологической катастрофой огромных масштабов, причиняющей экологический ущерб на огромных территориях. Поэтому она не может не вызывать у нас самую серьезную тревогу, и эта проблема должна обязательно рассматриваться при планировании нашего будущего. Ее воздействие на здоровье нашего народа в будущем должно оцениваться как можно более объективным и беспристрастным образом. Поэтому мы всячески приветствуем партнерство в рамках международного сотрудничества в связи с данным проектом.

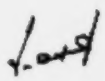
В.С. Казаков
Министр здравоохранения,
Республика Беларусь

Preface

The Chernobyl accident has demonstrated what was always known but perhaps has not been as fully acknowledged as it might, namely that national or other geographical boundaries are no defence against radioactive fallout. Much (some 2.2 millions) of the approximately 10 million population of Belarus have been, and are still being, exposed to the radiation resulting from the accident. The most obvious adverse effect of the radiation is on the condition of the thyroid system in children. Now, only just over seven years after the accident, we are experiencing an increase in childhood thyroid cancer which is particularly marked in those closest to the site of the accident. In young children thyroid cancer is an extremely rare condition and thus although at present the numbers of cases (some 200 since the accident) is not large in absolute terms it is a sufficiently important development to capture the interest of the international medical and scientific community and to give rise to considerable apprehension as to the future development of the outbreak.

Although this increase in thyroid cancer has not been definitively attributed to the Chernobyl accident, and indeed a major aim of this project is to elucidate the cause of the accident, the fact of the exposure of the population of Belarus to the isotopes of iodine at the time of accident, and what we have leaned from the experience in the Marshall Islands following the testing of the first hydrogen bomb on Bikini Atoll lead us to consider the accident as the most likely cause of the increase.

Belarus is a relatively small and newly independent country. By any standards the Chernobyl accident was a technological disaster of enormous proportions causing damage to the environment over vast land areas. Necessarily it must be a major concern for us and an issue to be considered in the planning of our future. Its impact on the future health of our nation must be assessed as objectively and dispassionately as possible and we therefore welcome the partnership of international collaboration that this project represents.



V. S. Kazakov
Minister of Health, Belarus

• *Background to the project*

The Chernobyl accident led to widespread radioactive contamination of the countries neighbouring the Chernobyl region in the Ukraine, with several million persons subject to exposure to radiation. The isotopes of iodine, which were particularly prominent in the radioactivity released in the early stages of the accident, are avidly retained by the thyroid gland and lead to substantial doses of radiation to the thyroid.

During 1991 and 1992, repeated claims were made by Belarussian physicians that thyroid cancer was increasing sharply, particularly in the Gomel region which is closest to Chernobyl. Under the joint auspices of the WHO Regional Office for Europe and the Commission of the European Communities (DG XII) an expert panel was convened in January 1992. Subsequently a mission sponsored by the WHO Regional Office for Europe visited Minsk and confirmed that the histopathological characteristics of the reported cancers were not consistent with over-ascertainment due to screening programmes and that there appeared to be an unusually large number of particularly aggressive cancers in young children in whom the disease is normally very rare. In September 1992, Belarussian physicians published details of the number and geographical distribution of cases (Scientific Correspondence: Nature, 3 September 1992). This report attracted some comment in the correspondence columns of the journal Nature, emphasizing the need for a careful investigation of the problem.

Although absolute proof that this increase in childhood thyroid cancer was due to exposure to radiation from the Chernobyl accident was lacking, the WHO team and Swiss pathologists who had also examined the histological material considered that a causal association with the isotopes of iodine was the most likely explanation. The latent period between the Chernobyl exposure and cancer development is short, but it would not be unprecedented to observe thyroid cancer some four years after the exposure. In the past, such early appearance has indicated a more substantial increase in later years and thus the possibility that the cases seen now are indicative of a much more severe problem to come has to be addressed.

While the incidence in the Gomel region as a whole appears to be declining in 1992, the incidence is increasing in the Brest region which was traversed by the initial radioactive plume after it crossed Gomel. In the Gomel region (total population about 2 million with 404,000 under the age of 15 years), the incidence rate is estimated to be greater than 100/million in 1992 (see Fig. 1). This figure for Gomel is an average and may be up to ten times higher in some districts in the south of the region, such as Bragin, Khoyniki and Narovlya.

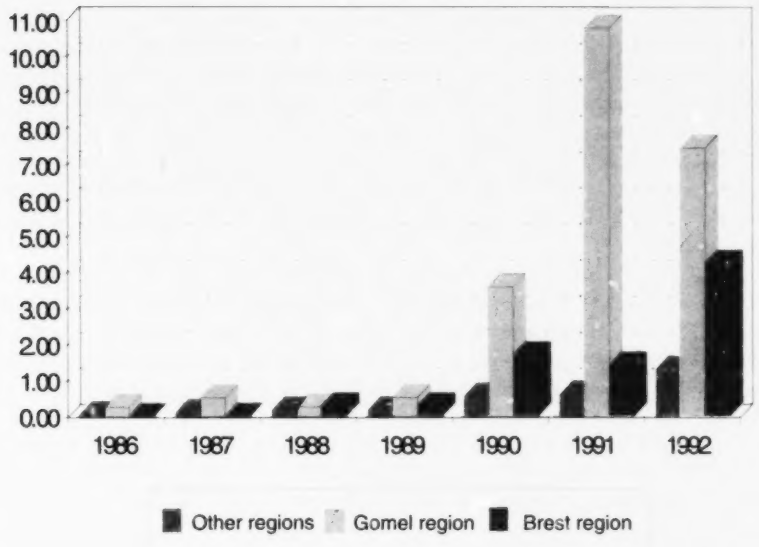


Fig. 1 - Incidence rate (per 100,000) of thyroid cancer in Belarus in children under the age of 15 since 1986. (Figures provided by Professor L. Astakhova, State Institute of Radiation Medicine, Belarus)

This increase places great strains on the health services in Belarus in terms of diagnosis, treatment and follow up. Childhood thyroid cancer is such a rare disease that experience in its treatment is scarce. The aggressive nature of the disease demands particular treatment regimes.

This project aims, by implementing an integrated programme of technical assistance and research, to assist Belarus in improving diagnosis, treatment and monitoring of the disease and to determine the origin, nature and likely extent of the outbreak.

- ***Justification for the project***

Health services in Belarus are organized on a hierarchical basis. Hospitals, clinics and dispensaries at the district level are familiar with diagnosis and treatment of goitre because of the mild iodine deficiency in the region. Conditions which appear malignant are referred to the district level for further diagnostic testing. If the opinion is still that the condition is malignant, the case is referred to the Clinic of the Research Institute of Radiation Medicine, Minsk (Aksakovschina), and then to the Centre for Thyroid Gland Cancer in Minsk.

The Centre in Minsk carries out further diagnostic tests in association with the Institute of Radiation Medicine, based at a hospital on the city's periphery. Operations are performed at the Centre for Thyroid Gland Cancer, and patients are transferred to the Clinic of the Radiation Medicine Institute for recovery and recuperation under surveillance.

International cooperation to exchange knowledge of modern methods of diagnosis and treatment, and the advantages of combining less radical methods of surgery with other therapeutic techniques would be of considerable value.

Facilities for histopathology are available at the Centre for Thyroid Gland Cancer and at other hospitals in Minsk. A central pathology facility is linked to the Medical Institute to which samples are also submitted. The system of referral of tissue samples and the recording of diagnosis is complex and the final authority lies with the Medical Institute. Cooperation with groups in other countries to exchange information on up-to-date methods of diagnosis (e.g. immunohistochemistry) and to help in histopathological training has started but needs to be intensified.

Epidemiological data are collected at the Laboratories of Epidemiology and Endocrinology at the Institute of Radiation Medicine. Data on diagnosed cases are passed to the Belarus Centre for Medical, Technology, Informatics, Management and Economy for the compilation of health statistics. At the beginning of each year, cancer data are passed to the Belarus Cancer Registry located at the State Research Institute of Oncology and Medical Radiology at Lesnoj on the periphery of Minsk and all diagnosed cases are recorded there. Computerization of records for this registry is in progress with support from the Swiss Government.

Early diagnosis is particularly important with the aggressive form of the disease which seems to be characteristic of this situation. A number of portable ultrasonic diagnostic machines are in use in Belarus at the district level for screening the asymptomatic population. A number of these machines have been supplied as part of the

IPHECA Thyroid Pilot Project under which 15,000 children from contaminated regions will be screened. In these circumstances annual screening of children is advisable and the magnitude of this task is totally out of proportion to the equipment presently available unless the population at risk can be more definitively identified. An important aim of the project is to better define this population using data collected by the cancer registry and to study incidence in relation to a number of factors such as micro-climate at the time of the accident, particular behavioural patterns (e.g. use of milk from privately owned cows, sleeping out of doors, drinking rain water). Further support for epidemiological work is necessary.

Childhood thyroid cancer need not be a fatal disease in the young, but prognosis depends not only on early diagnosis but on the mode of treatment. The rarity of the condition means that few centres worldwide have such expertise. The project aims to optimize the treatment regimes offered in Minsk by drawing on the best experience available. Materials and facilities considered essential elsewhere, particularly isotopes of iodine for diagnosis and treatment and γ-camera, for the successful treatment of childhood thyroid cancer are not readily available in Belarus.

Dosimetric information on exposure of the thyroid is incomplete at best and often non-existent. Direct thyroid measurements are available on only 100,000 persons of all ages, which will make it more difficult to determine the population at risk and the origin of the outbreak. The use of cultured cells from excised thyroid tissue to assess chromosome damage is being explored as a means of biological dosimetry. Some improvement in the means of determining the extent of exposure of the thyroid is urgently needed.

Plans are in progress to create new treatment, pathology and other laboratory facilities at Aksakovschina.

At present the origin of the outbreak, any special or distinguishing characteristics of the disease, and the ultimate extent of the outbreak can only be the subject of speculation based on very limited past experience. There is a need to learn more about the groups at risk and the nature of the condition and to follow more closely the development of the outbreak.

2 Aims and objectives of the project

The aim of the project is to provide Belarus with the means, through collaborative research, to control cancer, by learning how to prevent, diagnose and treat thyroid cancer that is occurring there. This aim will be achieved through four main objectives.

The objectives are:

1. To provide access to a coherent multidisciplinary network of centres of excellence through which Belarussian scientists and physicians can engage in collaborative research and receive technical assistance and training on the diagnosis, treatment and monitoring of the outbreak of thyroid cancer. Research projects will be directed to understanding the origin, nature and ultimate extent of the outbreak. It is anticipated that such a network will command the confidence of the international scientific and medical community and so attract further funding from outside bodies.

2. To provide funding for a programme of exchange visits by physicians and scientists to and from the Minsk Centre and specialized institutions for the purposes of research and training.

3. To provide a mechanism of supervision of the activities defined above that commands the confidence of the international community, both scientific and political.

4. To provide a mechanism that ensures coherence and coordination between the activities defined above and that ensures these activities are optimally integrated.

3 Structural framework of the project

International Chernobyl Thyroid Committee
(appointed by
International Regional Thyroid Associations)
ECR
Secretariat
Scientific Management
Committee
Funding
Bodies

8 Coordination with other studies

Annex 1 - Workplans for the collaborating centres

Name and Address of Institution	**Participating Department**	**Activities**	**Director of Institution**	**Head of Collaborating Centre**
University of Berne, Berne, Switzerland	Department of Social and Preventive Medicine	Epidemiology of thyroid disease: research, training, technical assistance and advice	Professor Peter Mürner	Professor Theodor Abelin
The Chancellors, Masters and Scholars of the University of Cambridge, The Old Schools Cambridge United Kingdom	Department of Histopathology University of Cambridge, Addenbrooke's Hospital, Cambridge CB2 2QQ UK	Pathology of thyroid disease: research, training, technical assistance and advice	The Vice Chancellor	Professor Sir Dillwyn Williams
Minsk, Belarus	To be decided	Local coordination of research, training and technical assistance in relation to the international thyroid project	To be decided	To be decided
Radiobiology Institute of the University of Munich, 80336 Munich, Schillerstr. 42 Institute of Radiobiology of the GSF, Ingolstädter Str 1, 85764 Oberschleisheim, Germany	Radiobiology Institute of the University of Munich	Dosimetry of the thyroid, cytogenetics of the thyroid; research, training, technical assistance and advice	Professor Albrecht Kellerer	Professor Albrecht Kellerer

(Workplans for the collaborating centres continued)

Name and Address of Institution	Participating Department	Activities	Director of Institution	Head of Collaborating Centre
University of Nagasaki, Nagasaki, Japan	First Department of Internal Medicine	Diagnosis of thyroid disease: research, training, technical assistance and advice	Professor Tetsuo Yokoyama	Professor Shigenobu Nagataki
Institute Gustave Roussy, Rue Camille Desmoulins, 94805 Villejuif Cedex, France	Department of Nuclear Medicine	Study of late effects of medical radiation exposure. Nuclear medicine aspects of thyroid disease: research, training, technical assistance and advice	Professor R. Flamant	Professor Martin Schlumberger
University of Pisa, Pisa, Italy	Department of Endocrinology, Calambrone Hospital, Tirrenia, Pisa	Management and treatment of thyroid disease: research, training, technical assistance and advice		Professor Aldo Pinchera

Terms of Reference

Berne

To participate in the International Thyroid Project (hereafter referred to as the Project) under the general direction of the Scientific Management Committee in the investigation of the origin, nature and likely extent of the increase in thyroid disease in communities affected by the Chernobyl accident as follows:

- To provide advice and training on the epidemiology of thyroid disease both by sending experienced staff to Minsk or other locations in the new, independent republics (NIS) where participants to the Project are engaged in the treatment and management of thyroid disease and receiving trainees from locations in the NIS,

- To engage in collaborative research projects on issues relating to the aims and objectives of the Project as they shall be determined by the Scientific Management Committee,

- To nominate one staff member to serve on the Scientific Management Committee of the Project.

- To advise WHO on issues relating to the epidemiology of thyroid disease.

Cambridge

To participate in the Project under the general direction of the Scientific Management Committee in the investigation of the origin, nature and likely extent of the increase in thyroid disease in communities affected by the Chernobyl accident as follows:

- To provide advice and training on the histopathology and pathobiology of thyroid disease both by sending experienced staff to Minsk or other locations in the NIS where participants to the Project are engaged in the treatment and management of thyroid disease or receiving trainees from Minsk or other NIS locations,

- To engage in collaborative research projects on issues relating to the aims and objectives of the Project as they shall be determined by the Scierntific Management Committee,

- To nominate one staff member to serve on the Scientific Management Committee of the Project,

- To advise WHO on issues relating to the pathology and pathobiology of thyroid disease.

Minsk

To participate in the Project under the general direction of the Scientific Management Committee in the investigation of the origin, nature and likely extent of the increase in thyroid disease in communities affected by the Chernobyl accident as follows:

- To be responsible for the coordination of all activities within the Project in Belarus,

- To engage in collaborative research projects on issues relating to the aims and objectives of the Project as they shall be determined by the Scierntific Management Committee,

- To nominate one staff member to serve on the Scientific Management Committee of the Project,

- To advise WHO on issues relating to the incidence of thyroid disease in Belarus.

Munich

To participate in the Project under the general direction of the Scientific Management Committee in the investigation of the origin, nature and likely extent of the increase in thyroid disease in communities affected by the Chernobyl accident as follows:

- To provide advice and training on the dosimetry of the thyroid gland both by sending experienced staff to Minsk or other locations in the NIS where participants in the Project are engaged in dosimetric work and by receiving trainees from NIS countries,

- To engage in collaborative research projects on issues relating to the aims and objectives of the Project as they shall be determined by the Scientific Management Committee.

- To nominate one staff member to serve on the Scientific Management Committee of the Project,

- To advise WHO on issues relating to the dosimetry of the thyroid gland.

Nagasaki

To participate in the Project under the general direction of the Scientific Management Committee in the investigation of the origin, nature and likely extent of the increase in thyroid disease in communities affected by the Chernobyl accident as follows:

- To provide advice and training on the diagnosis of thyroid disease both by sending experienced staff to Minsk or other locations in the NIS where participants in the Project are engaged in the diagnosis of thyroid disease and receiving trainees from locations in the NIS,

- To engage in collaborative research projects on issues relating to the aims and objectives of the Project as they shall be determined by the Scientific Management Committee,

- To nominate one staff member to serve on the Scientific Management Committee of the Project,

- To advise WHO on issues relating to the diagnosis of thyroid disease.

Paris

To participate in the Project under the general direction of the Scientific Management Committee in the investigation of the origin, nature and likely extent of the increase in thyroid disease in communities affected by the Chernobyl accident as follows:

- To provide advice and training on aspects of radiobiology and nuclear medicine relevant to the treatment and management of thyroid disease both by sending experienced staff to Minsk or other locations in the NIS where participants in the Project are engaged in the treatment and management of thyroid disease and receiving trainees from locations in the NIS,

- To engage in collaborative research projects on issues relating to the aims and objectives of the Project as they shall be determined by the Scientific Management Committee,

- To nominate one staff member to serve on the Scientific Management Committee of the Project,

- To advise WHO on issues relating to radiobiology and the application of nuclear medicine relevant to thyroid disease.

Pisa

To participate in the Project under the general direction of the Scientific Management Committee in the investigation of the origin, nature and likely extent of the increase in thyroid disease in communities affected by the Chernobyl accident as follows:

- To provide advice and training on the treatment and management of thyroid disease both by sending experienced staff to Minsk or other locations in the NIS where participants in the Project are engaged in the treatment and management of thyroid disease,

- To engage in collaborative research projects on issues relating to the aims and objectives of the Project as they shall be determined by the Scientific Management Committee,

- To nominate one staff member to serve on the Scientific Management Committee of the Project,

- To advise WHO on issues relating to the treatment and management of thyroid disease.

Annex 2 - Membership of the Scientific Management Committee

Minsk	(To be decided)
Berne	Professor Th. Abelin
Cambridge	Professor Sir Dillwyn William
Munich	Professor A. Kellerer
Nagasaki	Professor S. Nagataki
Paris	Professor M. Slumberger
Pisa	Professor A. Pinchera

Annex 3 - Membership of the International Chernobyl Thyroid Committee

American Thyroid Association (ATA):	D. Becker and J. Robbins
Asio-Oceanic Thyroid Association (AOTA):	C.J. Eastman and S. Nagataki
European Thyroid Association (ETA):	A. Pinchera and E.D. Williams
Latin American Thyroid Society (LATS):	O.J. Degrossi and J. Gross